that it consisted chiefly of humus and the acids of the crenic group.

From this analysis I thought myself justified in announcing that the lime and magnesia in the compound under consideration are combined with the phosphoric acid so as to form a tribasic salt, in which one atom of water substitutes one atom of alkaline earth, according to the formula 2 MO, HO, PO_5. A subsequent examination and recalculation of my results has convinced me that the announcement was somewhat premature, and that the analysis would not fully bear the construction put upon it. I have, however, never changed the opinion then advanced, as the discrepancies are slight and easily accounted for.

The statement of my views led to further investigation. Among others, Dr. Campbell Morfit examined the substance, and came to a different conclusion from that at which I had arrived. Drs. Higgins and Bickell, Chief and Assistant State Chemists of Maryland, shortly after published a paper in which they agreed with me in the main. Their analysis was more elaborate than mine, and comprised two distinct examinations; one of the white, polished crust, the other of the body of the rock. Without going into minutia, I will simply state that they found the exterior layer to contain phosphates of lime and magnesia, of the formula 3 MO PO_5 while, in the body of the rock, the salts were composed, as I had previously announced. They also ascertained that in the outer layer the sulphuric acid was combined with soda, while in the body of the rock it was united to lime.

A discussion ensued upon the application and effect of sundry articles used as manures, and their influence upon different soils and crops,—in which Dr. Dunglison, Prof. Frazer, Dr. F. Bache and Mr. Trego participated.

Stated Meeting, May 16.

Present, sixteen members.

Prof. Frazer, Vice-President, in the Chair.

Dr. S. L. Hollingsworth, a recently elected member, was introduced and took his seat.

The following donations were announced:—

FOR THE LIBRARY.

Proceedings of the American Association for the Advancement of Science. *Seventh Meeting*, held at Cleveland, Ohio, July, 1853:—and *Ninth Meeting*, held at Providence, R. I. August, 1855, 2 vols. 8vo.—*From the Association.*

Vierzigster Jahresbericht der Naturforschenden Gesellschaft in Emden, für 1854. 8vo.—*From the Natural History Society, Emden.*

Die Temperatur von Emden, als Ergebniss der daselbst von 1844 bis 1853, auf den Stand des Thermometers gerichteten Beobachtungen: von Dr. M. A. F. Prestel. 1855. 4to.—*From the Author.*

Proceedings of the Boston Society of Natural History. Vol. 5, Nos. 20, 21. Boston. 8vo.—*From the Society.*

Chambersburg, in the Colony and the Revolution. A Sketch. By Lewis H. Garrard, Mem. Hist. Soc. Penna. &c. Philadelphia, 1856. 8vo.—*From the Historical Society of Pennsylvania.*

Journal of the Franklin Institute. Third Series· Vol. XXXI. No. 5. May, 1856. Philadelphia. 8vo.—*From the Institute.*

The African Repository. Vol. XXXII. No. 5. May, 1856. Washington. 8vo.—*From the Am. Colonization Society.*

Constitution and By-laws of the Academy of Sciences of Saint Louis. St. Louis, 1856. 8vo.—*From the Academy.*

Reports of the Prison Discipline Society, Boston, 1826 to 1853. 3 vols. Boston. 8vo.—*From the Society.*

Flora Batava, of Afbeelding en Beschrijving van Nederlandsche Gewassen. Aflevering 178. Amsterdam. 4to.—*From the King of Holland.*

Standard Alphabet for reducing unwritten Languages and foreign Graphic Systems to a uniform Orthography in European letters. By Dr. R. Lepsius, Prof. Univ. and Mem. Roy. Acad. Berlin. 1855. 8vo.—*From the Author.*

The American Journal of Science and Arts. Second Series. Vol. XXI. No. 63. May, 1856. New Haven. 8vo.—*From Profs. Silliman & Dana, Editors.*

The U. S. Naval Astronomical Expedition to the Southern Hemisphere, during the years 1849, '50, '51, '52. Lieut. J. M. Gilliss, Superintendent. Vols. 1, 2. Washington, 1855. 8vo—*From the Hon. Job R. Tyson.*

Catalogue of the Books belonging to the Library Company of Philadelphia. Vol. III. Containing the Titles added from 1835 to 1856 :—together with an Alphabetical Index to the whole. Philadelphia, 1856. 8vo.—*From the Company.*

Dr. Franklin Bache announced the decease of Dr. John C. Warren, of Boston, a member of this Society, who died on the 4th inst. in the 78th year of his age.

Messrs. Eckfeldt and Dubois exhibited to the meeting an apparatus for ascertaining the specific gravity of ores, metals, coins, gems, &c. with the following descriptive communication.

The apparatus for taking specific gravity of solids is, essentially, a tin cup, with a spout at the side. Five vessels are here shown, of different sizes and shapes, to suit different cases. Four of these are cylindrical, ranging from six to ten inches high, and from two to five inches in diameter. The tall one (ten inches by two), is intended for the trial of silver spoons and forks, or articles of similar shape; the others are adapted to lumps of stone or metal, or blocks of wood, of various sizes. The fifth vessel is rectangular, measuring $6\frac{1}{2}$ inches high, $1\frac{3}{4}$ inches long, and $\frac{1}{4}$ inch broad, being intended for coins, not smaller than the half eagle, or quarter dollar, and for small medals, and gems of admissible size. This vessel is provided with a brass plate, as a *plunger*, for diminishing the surface. The smaller vessels are set firmly in mahogany blocks, to insure steadiness in the operation; and these blocks have screw feet, for convenience of levelling. The spouts extend upward, with a curve outward, the beak being far enough below the top of the cup to allow for the space to be taken up by the specimen, that it may not force the water over the top nor leave any point uncovered by water. The aperture of the spout is tapered to the one-sixteenth of an inch, and a small bit of wire projects downwards from the beak, to carry the drops of water properly. A small cup is placed directly under, to catch the water displaced, and a brass weight, equal to the weight of this cup when empty, is found convenient (though not necessary) as a counter-weight.

When the operation is to be performed, suppose upon a gold or silver ore, the ore is first weighed, and afterwards its surface is moistened. The vessel is then nearly filled with water, and so much as is superfluous, or above the level of the beak of the spout, runs or drips off, to a final drop. The small cup is then set under the beak, and the lump is carefully lowered into the vessel by a hair wire, or waxed thread. This, of course, displaces its own bulk of water, which runs off into the small cup, gradually coming back to the former level, by a final drop. The weight of this water is the divisor, the weight of the lump the dividend, and the quotient is the specific gravity.

In connection with this apparatus, the following miscellaneous remarks are offered to the Society.

The opening of the gold mines of California brought out a great number of beautiful specimens of gold in the matrix (or mingled with quartz) of the most fanciful forms, and every variety of size and value. In many cases it was presumed, by the holders of these prizes, that they would bring more money, as curiosities, than as bullion; and, at any rate, very many owners were unwilling to have such attractive specimens spoiled until they had been sufficiently exhibited. At the same time, it was always desirable to know, pretty nearly, how much gold was actually contained; and, to obtain such estimates, upon what was supposed to be reliable authority, many of these specimens were brought to the assay office of the mint. They came at a time when we were overpowered with the legitimate business of the office, and yet it seemed impossible to refuse such requests; and, for a considerable time, such employment was interesting as a matter of scientific inquiry. Especially when we could compare our estimates with the more definite and accurate results obtained by putting the specimens or "nuggets" through the regular routine of melting and assay. On one occasion a lump, weighing over 200 pounds, came to us for this purpose. It was sent by the Isthmus route, at a time when transportation was enormously dear, and having visible gold on the surface, was expected to be rich throughout the mass; and, with this expectation, was on the way to London, to make an impression upon the stock market there. By the aids of a very large steelyard beam and copper kettle, we were enabled to take the specific gravity, but could not make it higher than that of compact quartz. The result seemed so questionable, that we obtained permission to break up the rock, and found that what little gold it contained was at the surface.

Not only were ores brought to us from California, to be estimated, but also from other mining regions, and of various metals; but chiefly gold and silver. As the specimens were of all sizes, these demands upon us often proved embarrassing, since it was necessary to have beams suited to them, and with attachments for weighing in water. We therefore had frequent recourse to the method advised by the elder Dr. Patterson (formerly President of this Society), which consisted in using a jar or pitcher, rather larger than the specimen, and not over-large at the mouth; this was filled with water up to a marked line; and then, by introducing the specimen, and bringing back the water to the same line, so much water was removed as was just equal in bulk to the bulk of the specimen; the weight of this water gave the divisor, the weight of the specimen (taken while dry), the dividend, and the quotient was the specific gravity.

The results thus obtained were, generally, as satisfactory as those by the usual method. And here it may be interesting to cite a few examples, from our minutes, of specimens estimated by one or other of the processes mentioned, and afterwards melted down and assayed as regular deposits.

1. A lump of quartz, containing gold, found by two Mexicans of the "Sonorian camp," in California, weighed $265\frac{1}{2}$ ounces; assuming the quartz at the sp. gr. of 2.60, the amount of gold appeared by sp. gr. of the lump, to be $209\frac{1}{2}$ ounces; the actual amount was $211\frac{1}{8}$ ounces.—2. Another lump, where we assumed the matrix at 2.64, gave an estimate of $100\frac{1}{8}$ ounces of gold; the actual product was $100\frac{1}{10}$ ounces.—3. Four pebbles taken together, estimated at 77 ounces; actual content, $76\frac{8}{10}$ ounces.—And, lastly, a lump which had been bought in California for 800 dollars, and which weighed $408\frac{1}{2}$ ounces, gave an estimate of $89\frac{1}{2}$ ounces, or 1572 dollars, taking the matrix at 2.63; the actual yield was $91\frac{2}{10}$ ounces, or 1602 dollars; the fineness being 850 thousandths. In this case there was an error of 30 dollars, or about two per cent. upon the value; an amount of error to which such specimens are liable, with any apparatus.

But it was obvious that the method of displacement required a series of vessels, specially adapted to the operation, to compete with weighing, in closeness of results. After a good deal of reflection, and experimenting, in which many modifications of shape and arrangement were tried and discarded, and which it would be cumbersome to notice in this place, the apparatus now shown was found to answer best. In practice, it is really a pleasant and satisfactory substitute for the tedious and irksome method usually resorted to. Some few precautions must, of course, be attended to. The vessel must stand firmly. If at first the water will not flow, or flows fitfully, the obstruction will be removed by blowing a little in the spout.

An investigation of some interest, growing out of this matter, may properly be noticed. Where we are operating upon substances of low specific gravity, say wood or stone, a drop or two of water, or the size of the drop, in tapering off the divisor, is of no consequence. But it is otherwise in the case of a gold coin, for example:—in a double eagle, the difference of one drop of water (ordinarily about a half-grain) in the divisor, would affect the result to the extent of 0.3, which, carried into the fineness, would make a difference of 15 or 20 thousandths; and in the case of a half-eagle, the uncertainty of result would be proportionally increased. The question then arose, what fluid, or what modification of water, will afford us a smaller drop? for, as was just observed, a half-grain is, on the average, the smallest weight of clean water that will detach itself by its own weight. Very much depends, of course, upon the size of the aperture, in the measure of drops of fluid; one drop of water, from a large beak, weighed $1\frac{1}{3}$ grains. In the Dispensatory of Drs. Wood and Bache, there is a table of the experimental results of Mr. Durand, showing the number of drops of different liquids equivalent to a fluidrachm (Page 1405). The differences are very remarkable; distilled water, for instance, being set down at 45 drops, and pure alcohol at 138 drops. And in our own experiments, the drop of alcohol was about one-third the weight of the drop of water, from the same pipette. This seemed to point to alcohol as a substitute; but there were obvious objections, and a much better vehicle was found in *soapy water*.

The best white soap, sold at the shops, is of the same specific gravity as water, and its mixture with water makes no change, in that respect. When the mixture is as strong as children use for blowing bubbles (we cannot conveniently give this measure in figures), the cohesion or tenacity of the water is so much weakened that the drop is reduced to one-tenth of a grain. No other fluid makes so small a drop as this. And there is the further advantage, that soapy water, though excellent for making bubbles, is less liable to retain them below the surface than pure water. So small a drop, of course, makes the experiment more tedious, and, by using less soap, the size of the drop will be, in many cases, advantageously increased.

Some years ago, at the desire of Prof. Henry, experiments were made in the assay-office, to test the comparative tenacity of pure water and soapy water, by observing how much weight, at a beam, would detach metallic disks held together by those fluids, respectively. This problem is more readily solved by the method just stated; namely, by observing the size of the drop.

This apparatus has a decided advantage for taking specific gravities of substances lighter than water; it being only necessary to hold them down by a pin or wire. By the usual method, the operation is complicated. The following are a few duplicate results, given to show the uniformity which is attainable by this mode.

Fine silver,	10.55	repeated,	10.55
Gold double eagle,	17.14	do.	17.37
Lead,	11.315	do.	11.307
Pyritous iron ore,	3.912	do.	3.919
Agate,	2.607	do.	2.604
Lithographic stone,	2.669	do.	2.670
Coarse quartz,	2.589	do.	2.599
Birch wood,	0.931	do.	0.934
White pine wood,	0.371	do.	0.379

These figures correspond sufficiently with the results given in books; which, however, very commonly disagree, even at the first decimal; chiefly because of the want of homogeneity, or uniform compactness in substances operated upon.

It will be objected to this process, that it is going back to the first crude idea of Archimedes, and rejecting subsequent improvements. It may claim, however, to be a refinement upon that philosopher's bath-tub; and if the operation is easy, and the results are good, not much further need be said. For specimens of very small size, and high density, the balance would be preferable; but the genuineness of a gold coin, as small as the half-eagle, is easily determined by the cup. And to demonstrate, to a class of learners, the *principle* of specific gravity, this is evidently to be preferred to the weighing in water, which is an after-thought of some complexity.

Stated Meeting, June 20.

Present, eleven members.

Prof. FRAZER, Vice-President, in the Chair.

Letters were read:—

From the Etat Major of the Corps of Mining Engineers of Russia, dated St. Petersburg, Feb. 25, 1855;—from the Imperial Society of Naturalists of Moscow, dated 1–13 August, 1855;—from the Imperial Academy of Sciences at Vienna,